IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Application of	)	
	)	
Mats Dahlbäck	)	Examiner: Weiping Zhu
	)	Art Unit: 1793
on METHOD, USE AND DEVICE RELATING	)	
TO NUCLEAR LIGHT WATER REACTORS	)	Confirmation No. 9490
	)	
Serial No.: 10/538,973	)	
	)	
Filing Date: June 14, 2005	)	(Docket No. 1026-0003WOUS)

Middletown, Connecticut, May 5, 2009

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

This Appeal Brief is respectfully submitted to the Board following the Notice of Appeal filed on March 5, 2009.

I. REAL PARTY IN INTEREST

The real party in interest in this Appeal is Westinghouse Electric Sweden AB, of Vasteras, Sweden.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interference proceedings known to Appellant, Appellant's legal representatives, or assignees that would directly affect or be directly affected by or have a bearing on the decision of the Board of Patent Appeals and Interferences in this Appeal.

III. STATUS OF CLAIMS

Claims 18-21, 23, and 31 are pending and are under appeal from the Examiner's final rejection. Claims 1-17, 22, and 24-30 have been cancelled.

IV. STATUS OF AMENDMENTS

No amendments have been proposed in response to the final Office Action.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 18 is drawn to a method of producing and treating a sheet suited to be used as a component or as a part of a component in a fuel assembly for a nuclear light water reactor. (Substitute specification, page 10, lines 1-3 (para. 41)). The nuclear light water reactor can be a boiling water reactor. (Substitute specification, page 10, lines 7-8 (para. 42)). The method includes the step of producing a sheet of a Zr-based alloy by forging, hot rolling, and cold rolling in a suitable number of steps, the alloy containing at least 96 weight percent Zr. (Substitute specification, page 4, lines 13-15 (para. 15)). The method also includes the step of carrying out one of an $\alpha+\beta$ quenching

and a β quenching of the sheet when the sheet has been produced to a thickness which is one of equal to the final thickness of the finished sheet and approximately equal to the final thickness of the finished sheet. (Substitute specification, page 4, lines 17-20 (para. 15)). The method further includes the step of heat treating the sheet in the α-phase temperature range of the alloy. (Substitute specification, page 4, lines 21-22 (para. 15)). The step of heat treating the sheet in the α-phase temperature range of the alloy is carried out after the steps of producing the sheet and quenching have been carried out. (Substitute specification, page 4, line 23 (para. 15)).

The sheet is stretched during the step of heat treating in the α-phase temperature range of the alloy, which is carried out after the quenching. (Substitute specification, page 4, line 31, to page 5, line 2 (para. 16)). The stretching and the heat treatment are carried out in a continuous oven process. (Substitute specification, page 5, lines 17-18 (para. 16)). The stretching is carried out such that the sheet directly after having gone through the stretching has a remaining elongation compared to the state of the sheet immediately before the stretching (Substitute specification, page 6, lines 25-27 (para. 22)), and the remaining elongation is between about 0.1% and about 7% (Substitute specification, page 6, line 30 (para. 22)). Furthermore, the component formed by the method as recited in independent claim 18 defines a longitudinal direction which, when the component is used in the fuel assembly, is at least substantially parallel to a longitudinal direction of the fuel assembly and in which the stretching of the sheet is carried out in a direction that corresponds to the longitudinal direction of the component for which the sheet is intended. (Substitute specification, page 7, lines 16-21 (para. 23)).

Independent claim 31 is drawn to a method that is similar to that recited in claim 18. The method of claim 31 differs in that the remaining elongation after the stretching is between about 0.2% and about 4% (Substitute specification, page 6, line 31 (para. 22)).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The grounds of rejection to be reviewed on Appeal is whether claims 18-21, 23, and 31 are patentable under 35 U.S.C. §103(a) over U.S. Patent No. 6,149,738 to

Dahlbäck (hereinafter “Dahlbäck”) in view of U.S. Patent No. 6,176,104 to Garzarolli et al. (hereinafter “Garzarolli”).

VII. ARGUMENT

Claims 18-21, 23, and 31 are patentable within the meaning of 35 U.S.C. §103(a).

. The Examiner’s rejection of claims 18-21, 23, and 31 under 35 U.S.C. §103(a) as allegedly being unpatentable over Dahlbäck in view of Garzarolli is improper.

The Examiner alleges, with respect to at least the independent claims, that Dahlbäck discloses a method of producing and treating a sheet for a component in a fuel assembly for a nuclear light water reactor comprising: producing a sheet of a Zr-based alloy by forging, hot-rolling, and cold-rolling in a number of steps, wherein the alloy contains by weight at least about 96% Zr; carrying out a β-quenching when the sheet has been produced in the finished dimension or almost finished dimension; and heat treating the sheet after the β-quenching in a temperature range of 600-800 degrees C (i.e., the α-phase temperature range of the alloy). The Examiner admits that Dahlbäck does not disclose that the sheet is stretched by 0.1% to 7% or 0.2% to 4% in a direction corresponding to a longitudinal direction of a component for which the sheet is intended during the heat treatment. The Examiner alleges that Dahlbäck discloses that during the heat treatment, the flatness of the sheet is restored. The Examiner also alleges that Garzarolli discloses lengthening a tube during a straightening operation by stretching the tube by at least 0.3% of the initial length of the tube in the longitudinal direction and that the stretching amount range of Garzarolli overlaps the ranges as recited in claims 18 and 31. Accordingly, the Examiner alleges that a prima facie case of obviousness exists and that it would have been obvious to one of ordinary skill in the art at the time the invention was made to flatten the sheet by stretching it by at least 0.3% in a direction corresponding to a longitudinal direction of a component for which the sheet was intended during the heat treatment as disclosed by Garzarolli in order to generate internal stress in the sheet.

Dahlbäck discloses a fuel box and a method for manufacturing zirconium alloy plates for fuel boxes. The method includes a heat treatment method in which the plates are β-quenched. According to Dahlbäck, the ductility of the material of the plates is not deteriorated by this treatment. (Dahlbäck, column 2, lines 57-65.) In the method, a finely lamellar basketweave structure (namely, the Widmanstatten structure) is favorable for carrying out the bending of the plates in order to avoid cracking. (Dahlbäck, column 3, lines 1-3.) In manufacturing the material for the plates, alloying elements are added to zirconium to form a zirconium alloy ingot. The ingot is forged in the β-phase region. (Dahlbäck, column 5, lines 1-4.) The forging is reduced by hot rolling, during which the temperature is kept to a minimum. Thereafter, the material is cold-rolled in a number of steps down to the finished dimension. The material is then β-quenched in an effort to improve corrosion properties and ductility. A heat treatment using infrared lamps is then performed. The resulting plate material exhibits a microstructure that is characterized by the finely lamellar basketweave structure. (Dahlbäck, column 5, lines 15-40.) Dahlbäck explicitly notes that to restore the flatness of the material after β-quenching, the material is heat treated after the β-quenching. (Dahlbäck, column 4, lines 52-55.)

Garzarolli discloses a pressurized water reactor fuel assembly having a guide tube. Also disclosed in Garzarolli is a method for producing a guide tube for control elements. The guide tubes are composed of zirconium alloys and show sharp radiation-induced growth in the axial direction at the start of their use in a reactor core. This sharp initial growth is compensated for by an inherent contraction of the tubes. For this purpose, the tubes are given internal stresses which are reduced by the tube contraction as a result of supplied energy. These internal stresses are generated such that the tube is lengthened during a straightening operation in a last production step of the tube. Some guide tubes are subsequently lengthened by at least 0.3%, and preferably at least approximately 0.4% to 0.5% of the length of the initial tube. Garzarolli explains that the lengthening concludes the production of the tubes (Garzarolli, column 4, lines 32-35). Moreover, Garzarolli suggests the use of a straightening bench (Garzarolli, column 2, lines 8-16, and column 4, lines 46-64).

Both Dahlbäck and Garzarolli fail to disclose, teach, or suggest a method of producing and treating a sheet suited to be used as a component or as a part of a

component in a fuel assembly for a nuclear light water boiling water reactor in which the sheet is stretched in the α-phase temperature range of the alloy. No such disclosure is found in either Dahlbäck or Garzarolli. The term "stretching," in accordance with common usage and as applied to claim 18, means that the sheet is pulled in order to become longer. The pulling of the sheet in any direction (stretching as recited in the claims) is noticeably absent in both of the cited references. Accordingly, because neither Dahlbäck nor Garzarolli disclose "stretching," they necessarily fail to teach stretching in the α-phase temperature range of the alloy.

Furthermore, both Dahlbäck and Garzarolli fail to disclose, teach, or suggest the stretching of the sheet as occurring during a heat treatment of the sheet. As recited in claim 18, the stretching is carried out in a continuous oven process, but because neither Dahlbäck nor Garzarolli disclose stretching, they necessarily fail to teach stretching during heat treatment in a continuous oven process as is recited in claim 18.

It should also be noted that in Dahlbäck, in the passage in column 4, lines 52-59, it is stated that the heat treatment is performed in order to improve corrosion properties and to restore the flatness. Restoration of flatness by using heat treatment does not utilize a stretching procedure (i.e., restoration of flatness of a sheet using heat treatment does not involve pulling the sheet). Therefore, the stretching of the sheet, as recited in claim 18, is different from the heating of the sheet to restore flatness, as in Dahlbäck.

Dahlbäck is insufficient to address the problems that the present invention as recited in claim 18 attempts to solve. The present invention as recited in claim 18 addresses the problem of providing a flat sheet in as few steps as possible by stretching the sheet. There is no stretching in Dahlbäck, only a heat treatment that attempts to restore flatness. The final heat treatment described in Dahlbäck will release some tensions (that have been introduced during the previous β-quenching) and will therefore contribute to the flatness of the sheet (although no stretching is performed); however, this contribution will not make the sheet sufficiently flat. The final heat treatment in Dahlbäck to contribute to the flatness of the sheet, therefore, is the performance of a "non-stretching" straightening procedure of the sheet immediately following the β-quenching step. This "non-stretching" straightening procedure does not solve the

problem of providing a flat sheet in as few steps as possible, as the present invention as recited in claim 18 solves.

Furthermore, the straightening procedure in Dahlbäck introduces additional stresses in the sheet. Therefore, when the sheet in Dahlbäck is subsequently heat-treated, which will result in the tensions being released, then the sheet will become less flat again. Using the technique of Dahlbäck, it has therefore previously been necessary to perform a straightening procedure again, followed by a further heat treatment in order to release tensions. The procedure of performing successive straightening operations is rather complicated and lengthy, which are some of the problems that the present invention as recited in claim 18 corrects.

Dahlbäck also fails to disclose, teach, or suggest a method of producing and treating a sheet in which stretching is carried out such that the sheet has a remaining elongation, as is recited in claim 18. Dahlbäck does not at all suggest any remaining elongation (since, in fact, no stretching at all is suggested and in particular no stretching during a final heat treatment), nor does Dahlbäck suggest stretching in any particular direction.

Furthermore, Dahlbäck is concerned with a completely different problem than the present invention, namely, that of obtaining a particular kind of Widmanstatten structure in a box wall for a fuel assembly for a BWR in order to avoid cracking when bending the box plate. This is described in Dahlbäck at column 2, line 66, to column 3, line 9. Dahlbäck, therefore, is not concerned with the same problem as the present invention and there is no indication that the problem that Dahlbäck is concerned with could be solved by any stretching of the sheet during a heat treatment.

Garzarolli is neither compatible with Dahlbäck, nor with the ideas of the present invention. The present invention, as defined in claim 18, (and Dahlbäck) is concerned with a sheet for a BWR. In marked contrast, Garzarolli is directed to pressurized water reactors.

It should be noted that there are two kinds of modern light water reactors: the boiling water reactor (BWR) and the pressurized water reactor (PWR). In both of these types of reactors, substantially different conditions exist (in particular, the corrosion conditions in each are substantially different). Therefore, the components used in these

different reactors and the treatments of the components are different in order to adapt the components to the specific kind of reactor and to the specific corrosive environment.

The fuel assemblies used in both of these kinds of reactors are also of substantially different construction. For example, a fuel assembly for a PWR normally has guide tubes (as disclosed by Garzarolli) for control rods (which thus are inserted into the guide tubes within the fuel assembly), while a fuel assembly for a BWR normally does not have any such guide tubes. In a BWR the control "rods" usually consists of four blades that protrude from a central part (see for example WO 02/101754 A1, Figure 1). Such a control rod for a BWR is inserted between the fuel assemblies (and not into any guide tubes).

Dahlbäck concerns only a BWR (see for example column 1, lines 6-9). Garzarolli, on the other hand, is concerned only with a PWR (see column 1, lines 16-17). For at least this reason, the documents are not compatible with each other because of the different conditions and designs that pertain to the different kinds of nuclear reactors.

Furthermore, as mentioned above, Dahlbäck is concerned with obtaining the plate (Widmanstatten) structure for a BWR, whereas Garzarolli is not at all concerned with this problem. In fact, Garzarolli is not concerned with any plate structure at all. Instead, Garzarolli is concerned with the problem of radiation induced growth of guide tubes (see for example column 1, lines 36-42). As explained above, such guide tubes do not even exist in a fuel assembly for a BWR.

Moreover, it should be noted that in a PWR the guide tubes hold the whole fuel assembly together, since they are connected to an upper and lower cover plate (see for example Garzarolli, column 1, lines 15-20, and column 2, lines 57-62). This means that if the guide tubes grow, caused by neutron radiation, then the whole fuel assembly will grow, which may actually cause or at least exacerbate the problems as described in Garzarolli (see in particular column 1, lines 24-33 and column 3, lines 16-30).

Since in a BWR the control rods are inserted between the fuel assemblies and do not form part of the fuel assemblies, a possible growth of the control rod does not affect the fuel assemblies. In a PWR, on the other hand, the growth of the guide tubes in the longitudinal direction may cause particular problems as explained in Garzarolli. Since this is a problem specific for a PWR and since the BWR does not contain any such guide

tubes, Garzarolli with Dahlbäck cannot be combined to render the present invention as recited in claim 18 obvious, as suggested by the Examiner.

It should also be noted that the growth caused by neutron radiation is normally not a problem for the parts (such as the sheets used for the walls) of a fuel assembly for a BWR, if such parts have gone through a suitable heat treatment. The sheets used as parts of such a fuel assembly can go through a ß-quenching, as recited claim 18. By such a quenching, a randomized texture is obtained in the sheet. With such a randomized texture, the neutron radiation will not cause any particular growth in the longitudinal direction (since the texture is randomized, the growth will not appear in any particular direction; instead, any growth caused by neutron radiation will be equal in all directions, which means that the fuel assembly will not be particularly extended in the longitudinal direction).

Furthermore, unlike the present invention, Garzarolli is not concerned with the problem of increasing the flatness and the corrosion properties of an object. Since the guide tubes with which Garzarolli is concerned are round, it would of course be completely contrary to the teaching of Garzarolli to make these tubes flat.

Furthermore, neither Garzarolli nor Dahlbäck suggests any stretching <u>during a heat treatment</u>. Instead, Garzarolli explains that the lengthening concludes the production of the tube (see column 4, lines 32-35). Moreover, Garzarolli suggests the use of a straightening bench (see column 2, lines 8-16 and column 4, lines 46-64, in particular lines 63-64). Moreover, Garzarolli does not at all suggest or even indicate the possibility of carrying out the stretching during the heat treatment in a continuous oven process.

As stated above, Dahlbäck does not suggest any stretching, and in particular not during a heat treatment and, moreover, Dahlbäck does not at all suggest any stretching during a heat treatment in a continuous oven process.

Also as stated above, because Garzarolli is directed to a completely different type of nuclear reactor, Garzarolli is inapplicable for the purposes of rejecting the claims of the present application.

The subject matter of independent claim 31 is also new and non-obvious for the above given reasons. In particular, in claim 31, a preferred remaining elongation of between about 0.2% and 4% is defined, which further limits the method of independent

claim 18. Accordingly, there is no indication in the cited documents which would lead a person skilled in the art to the method as recited in claim 31.

Appellants also respectfully submit that since the Examiner accurately points out and admits that Dahlbäck does not disclose that the sheet is stretched by 0.1% to 7% (as in claim 18) or 0.2% to 4% (as in claim 31), and since Garzarolli is directed to a PWR in which the properties and characteristics thereof are not applicable to a BWR (as in Dahlbäck), Dahlbäck and Garzarolli are not properly combinable to reject either claim 18 or claim 31.

Because neither Dahlback nor Garzarolli individually disclose, teach, or suggest the same element of the method, namely, stretching the sheet during heat treatment of the sheet in the α-phase temperature range of the alloy, as recited in claim 18 and also in claim 31, and because neither Dahlback nor Garzarolli disclose, teach, or suggest carrying out the stretching and heat treatment in a continuous oven process, as recited in claims 18 and 31, any combination thereof would also necessarily fail to disclose, teach, or suggest such an element of the method. More specifically, any combination of Dahlback and Garzarolli fails to teach stretching the sheet during heat treatment of the sheet in the α-phase temperature range of the alloy, as recited in claim 18 and also in claim 31. Furthermore because neither Dahlback nor Garzarolli individually disclose, teach, or suggest carrying out the stretching and heat treatment in a continuous oven process, as recited in claims 18 and 31, any combination of these references fails to disclose, teach, or suggest the invention as recited in claims 18 and 31. Moreover, because Dahlback is not properly combinable with Garzarolli, a person skilled in the art would not look from one to the other as alleged by the Examiner. For at least these reasons, the present invention as recited in claims 18 and 31 is not obvious in view of Dahlback and Garzarolli, and Appellant respectfully requests that the rejection of these claims be withdrawn and the application be allowed to issue.

Moreover, any claim that depends from a claim that is non-obvious is itself necessarily non-obvious. Claims 19-21 and 23 depend from claim 18, which is asserted to be non-obvious for the reasons presented above. Thus, claims 19-21 and 23 are themselves necessarily non-obvious. Appellant, therefore, respectfully requests that the rejections of claims 19-21 and 23 be withdrawn and the application be allowed to issue.

The present invention, as recited in at least claims 18 and 31, brings about several advantages that are not suggested by Dahlbäck, Garzarolli, and a combination thereof.

First, tensions created during the phase transformation during the β-quenching or α + β-quenching are released, which leads to the formation of a flat and straight sheet. The procedure is also much simplified compared to prior art processes, since no subsequent treatments in order to make the sheet flat are necessary.

Furthermore, improved corrosion properties are achieved, since the stretching increases the diffusion speed, which makes it possible to control the growth of secondary phase particles by controlling the stretching. The obtained increased diffusion speed is particularly advantageous in a continuous oven process, since this makes it possible to obtain a desired growth of secondary phase particles in such an oven process. These factors lead to the improved corrosion properties.

The fact that the stretching and heat treatment are carried out in a continuous oven process, as defined in both claim 18 and claim 31, is clearly advantageous also for the reason that it is thereby not necessary to use any separate stretching bench.

Moreover, to perform the stretching such that the particular remaining elongation as defined in claims 18 and 31 is obtained is particularly advantageous, since an excessively large elongation can lead to a less randomized grain texture and to impaired ductility.

Additionally, to carry out the stretching in the direction defined in claims 18 and 31 is particularly advantageous, since for an elongate object the stretching can be more easily carried out in such a direction. This is particularly advantageous in a continuous oven process

Conclusion

For the reasons discussed above, this application is in a condition for allowance and thus reversal of the outstanding rejections and allowance of the application is appropriate.

The fee for filing this Appeal Brief is submitted herewith. If additional charges are incurred with respect to this Appeal Brief, they may be charged to Deposit Account No. 503342 maintained by Appellant's attorneys.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

18. A method of producing and treating a sheet suited to be used as a component or as a part of a component in a fuel assembly for a nuclear light water boiling water reactor, which method comprises the following steps:

a) producing a sheet of a Zr-based alloy by forging, hot rolling and cold rolling in a suitable number of steps, wherein said alloy contains at least about 96 weight percent Zr;

b) carrying out one of an $\alpha+\beta$ quenching and a β quenching of the sheet when the sheet has been produced to a thickness which is one of equal to the final thickness of the finished sheet and approximately equal to the final thickness of the finished sheet;

c) heat treating of the sheet in the α-phase temperature range of said alloy, wherein step c) is carried out after steps a) and b) have been carried out, and wherein the sheet is stretched during the heat treatment according to step c);

wherein said stretching and said heat treatment during step c) are carried out in a continuous oven process;

wherein said stretching is carried out such that the sheet directly after having gone through the stretching has a remaining elongation compared to the state of the sheet immediately before the stretching;

wherein said remaining elongation is between about 0.1% and about 7%; and

wherein said component defines a longitudinal direction which, when the component is used in said fuel assembly, is at least substantially parallel to a longitudinal direction of the fuel assembly and wherein said stretching of the sheet is carried out in a direction which corresponds to the longitudinal direction of said component for which the sheet is intended.

19. A method according to claim 18, wherein step b) is a β quenching.

20. A method according to claim 18, wherein said stretching is carried out at a temperature of at most the temperature which constitutes the highest temperature in the α-phase temperature range of the alloy and at least at the temperature which is about 70% of said highest temperature in °K.

21. A method according to claim 20, wherein said stretching is carried out at a temperature which is between about 80% and about 98% of said highest temperature in °K.

23. A method according to claim 18, wherein said stretching is carried out such that said elongation is longer than a critical degree of deformation of the alloy.

31. A method of producing and treating a sheet suited to be used as a component or as a part of a component in a fuel assembly for a nuclear light water boiling water reactor, which method comprises the following steps:

a) producing a sheet of a Zr-based alloy by forging, hot rolling and cold rolling in a suitable number of steps, wherein said alloy contains at least about 96 weight percent Zr;

b) carrying out one of an $\alpha+\beta$ quenching and a β quenching of the sheet when the sheet has been produced to a thickness which is one of equal to the final thickness of the finished sheet and approximately equal to the final thickness of the finished sheet;

c) heat treating of the sheet in the α-phase temperature range of said alloy, wherein step c) is carried out after steps a) and b) have been carried out, and wherein the sheet is stretched during the heat treatment according to step c);

wherein said stretching and said heat treatment during step c) are carried out in a continuous oven process;

wherein said stretching is carried out such that the sheet directly after having gone through the stretching has a remaining elongation compared to the state of the sheet immediately before the stretching; and

wherein said remaining elongation is between about 0.2% and about 4%; and

wherein said component defines a longitudinal direction which, when the component is used in said fuel assembly, is at least substantially parallel to a longitudinal direction of the fuel assembly and wherein said stretching of the sheet is carried out in a direction which corresponds to the longitudinal direction of said component for which the sheet is intended.

IX. EVIDENCE APPENDIX

No evidence is submitted with this Appeal Brief.

X. RELATED PROCEEDINGS APPENDIX

No related proceedings are known to Appellant, Appellant's legal representatives, or assignees.